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United States Patent [19]

Grunert et al.

US005394126A

[11] Patent Number: 5,394,126

[45] Date of Patent: Feb. 28, 1995

[54] CIRCUIT BREAKER WITH IMPROVED MAGNETIC TRIP ASSEMBLY

[75] Inventors: Kurt A. Grunert; William E. Beatty, both of Beaver, Pa.

[73] Assignee: Eaton Corporation, Cleveland, Ohio

[21] Appl. No.: 229,039

[22] Filed: Apr. 18, 1994

[51] Int. Cl.[6] H01H 75/10

[52] U.S. Cl. 335/42; 335/18

[58] Field of Search 335/167-76, 335/21, 22, 23, 35, 38, 42, 40, 45

[56] References Cited

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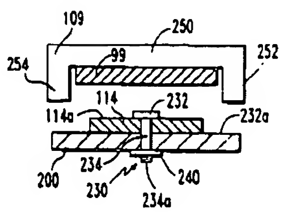
Primary Examiner—Lincoln Donovan

Attorney, Agent, or Firm—Martin J. Moran

[57] ABSTRACT

A circuit breaker with improved magnetic trip assembly includes electrical contacts operable between a closed position in which a circuit is completed and an open position in which the circuit is interrupted, a latchable operating mechanism operable to open the electrical contacts when unlatched and a trip bar rotatable from a biased position to a trip position to unlatch the operating mechanism. The circuit breaker further includes a magnetic trip assembly comprising a stationary magnetic structure, a movable armature which is attracted to the stationary magnetic structure by an abnormal current through the conductor to rotate the trip bar to the trip position and a plate means mounted to the movable armature and disposed between the armature and the stationary magnetic structure. The plate means adjusts the amount of abnormal current required to attract the movable armature to the stationary magnetic structure and in turn rotate the trip bar.

9 Claims, 6 Drawing Sheets



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sliding the trip bar 89 axially. Due to the bevelled surface 171 on the actuating lever 103, spacing between the bimetal and the trip bar is adjusted. The camming device 177 is also accessible through the top cover of the circuit breaker 1 as shown in FIG. 1. Calibration of the bimetal can be effected at the factory through rotation of a screw 181.

(29) A current bearing conductive path between the lower end of the bimetal 99 and the upper electrical contact 27 is achieved by a flexible copper shunt 183 connected by any suitable means, for example by brazing to the lower end of the bimetal 99 and to the upper electrical contact 27 within the cross bar 49. In this manner, an electrical path is provided through the circuit breaker 30 between the terminals 9b and 11b via the lower electrical contact 25, the upper electrical contact 27, the flexible shunt 183, the bimetal 99, and the conductive member 167.

(30) Adjustment of the camming device 177 varies the response time of the circuit breaker to low level over currents. Since the bimetal 99 is surrounded by the stationary magnetic structure 109, the current conducted by the bimetal generates a magnetic field in the stationary magnetic structure which attracts the armature 111. The spring bias set by adjustment of the adjusting bar 131 through rotation of the camming device 149 adjusts the level of current at which the armature is attracted to the stationary magnetic structure. The screws 159, 161 and 165 provide for fine adjustment of the trip current at the high, low and all settings of spring bias respectively.

(31) Once the circuit breaker leaves the factory and is delivered to the customer, in operation, the circuit breaker 1 is set to the CLOSED position as shown in FIG. 3. A current which exceeds the magnetic trip setting established by the spring bias through the camming device 149, the adjusting screws 159, 161 and 165 and the position of the plate means 114 generates a magnetic field in the stationary magnetic structure 109 sufficient to pull the armature 111 and the plate means 114 toward it in a clockwise direction is viewed in FIG. 3. The lower end of the armature rotates the trip bar in the clockwise direction until the cradle latch plate 91 slides off of the trip lever 105. This unlatches the cradle 61 permitting the operating tension springs 57 to rotate the cradle 61 counter-clockwise as viewed in FIG. 3 which causes the toggle mechanism 47 to break over to the position shown in FIG. 6 thereby opening a

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14	335/42	335/38	13	US 5394126	Circuit breaker with improved magne
15	335/35	335/42	10	US 5381120	Molded case circuit breaker thermal-

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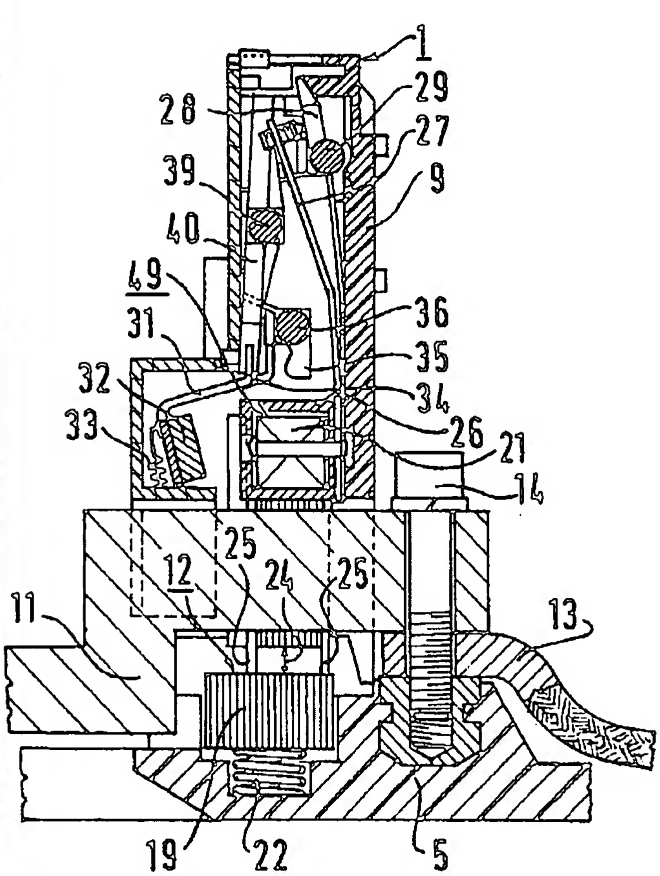
FIG.4



(4) A spring 22 disposed in a recess 23 of the stand 5 and lying between said stand 5 and said floating part 19 holds this floating part pressed against the part 49.

(5) In FIG. 4, the air gap 24 which exists between the two separable parts 19 and 49 of the magnetic circuit 12 is determined by two non-magnetic metal sheets 25 situated on either side of the laminations 21 of the said other part 49 and on which the said one magnetic part 19 abuts due to the effect of the spring 22. The central portion of the U-shaped laminations 21 (FIG. 7) is surrounded by a conductive ring 26 forming a short-circuit turn for the secondary winding of the transformer, for which the conductor 11 forms the primary winding, while the other end of a thermal switch 27 in thermal contact with said ring 26 operates an arm 28 on an auxiliary thermal release shaft 29 to which it transmits its thermo-mechanical movement

(6) In FIG. 5, the electromagnetic short-circuit detector includes a pair of soft steel plates 30 forming a separable part of a magnetic circuit fixed to the laminations 21 and the non-magnetic metal sheets 25 on the insulating casing 9 of the tripping device 1. The short-circuit detector also includes a magnetic armature 32 fixed to a mobile plate 31 fitted with return springs 33.

(7) When there is a short-circuit, the current passing through the conductor 11 energizes the magnetic circuit which includes the soft steel plates 30 and which is completed across the spring-loaded portion 19 of the magnetic circuit 12 which surrounds said conductor 11. The soft iron plates 30 then attract the armature 32 fixed on the mobile plate 31 which has an end 34 that operates an electromagnetic tripping arm 35 (FIG. 4). The short-circuit current is adjusted to cause tripping by means of a knob 37 which operates an adjusting arm 38 which rotates an adjusting bar 39 which has another arm 40 (FIG. 4) that varies the distance between the armature 32 and the soft steel plates 30.

(8) In FIG. 6, the means for accurate positioning of the hook 6 of said tripping device with respect to the control mechanism of the circuit-breaker 2 is shown. FIG. 6 also shows the fixing, by means of the screws 7 with the interposed springs 8 (compatible with the wide manufacturing tolerances for the casing 9) said tripping device 1 to the stand 5 of the circuit-breaker 2. The resilient bias of the springs 8 determines the application force of the

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					...e electromagnetic tripping
					...aker having a cam for exte...
					...rip adjustment based on s...
					...for variably adjusting a ma...
51	335/42	335/176	8	US 4130814	Interchangeable tripping device for c...
52	335/42	335/176;	33	US 4114123	Circuit breaker

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U.S. Patent May 28, 2002 Sheet 6 of 6 US 6,396,370 B2

FIG. 8

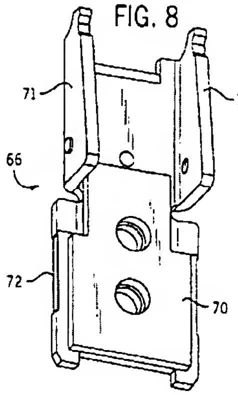


FIG. 10

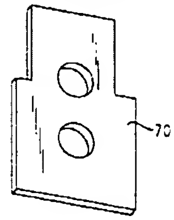
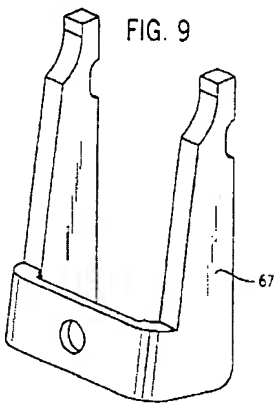


FIG. 9



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magnetic forces acting on the conductors in the circuit breaker. Because the short circuit let-through current is higher for the higher current rated breakers, such breakers experience higher magnetic forces on the conductors then do the lower rated breakers. The short circuit current magnetic forces can have an adverse affect on the subsequent performance of the circuit breaker. In a higher current rated breaker, for example 100 amps. or higher, the short circuit forces may be high enough to cause permanent deformation of the bi-metal/load terminal assembly in the trip mechanism. This deformation may change the thermal calibration characteristics of the breaker, or may interfere with resetting of the mechanism latch. On a lower current rated breaker, for example 40 amps. or below, the short circuit let-through currents and magnetic forces are lower. In such cases, deformation of the trip mechanism typically does not occur.

(19) In the present bi-metal trip mechanism 60 the assembly of the load bus 61 and bi-metal element 62, as shown in FIG. 5 can be used for a low current ratings, i.e., below 40 amps. The magnetic shield 72 is integral with the outer magnetic yoke 66 and is interposed between the load bus 61 and the bi-metal element 62. The two facilitate the necessary magnetic force to trip the breaker in the event of a short circuit condition, with an additional inner magnetic yoke 67 added to the assembly as show in FIG. 6. However, on the higher current rated breakers, i.e., 100 amps. or above, the outer magnetic yoke 66 with the integral magnetic shield 72 may not provide enough shielding to prevent the bi-metal/load terminal assembly from deforming. To provide additional magnetic shielding, a second magnetic shield 70 as shown in FIGS. 8 and 10 can be added to the outer yoke 66.

(20) FIG. 2 illustrates the bi-metal trip assembly 60 with the additional magnetic shield 70 installed and held in place by the rivets 69. The additional magnetic shield 70 may also be attached to the outer magnetic yoke by welding or other suitable attachment means. This method of providing additional magnetic shielding avoids the requirement of having two separate outer magnetic yokes for the various current ratings of the circuit breakers. A single outer magnetic yoke 66 can be used in a broad range of current ratings by adding such parts as the inner yoke 67 to amplify magnetic forces as necessary or to add the second magnetic shield 70 to protect from bi-metal deformation during high current conditions in the higher current rated circuit breaker.

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13	335/176 335/42	7	US 6396373	Adjustable armature assembly for a
14	335/35 335/172	12	US 6396370	Bi-metal trip unit for a molded case c

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United States Patent [19]

Leiber

[11] Patent Number: 4,711,266

[45] Date of Patent: Dec. 8, 1987

[54] VALVE ARRANGEMENT

[75] Inventor: Heinz Leiber, Oberriexingen, Fed. Rep. of Germany

[73] Assignee: Robert Bosch GmbH, Stuttgart, Fed. Rep. of Germany

[21] Appl. No.: 415,615

[22] Filed: Sep. 3, 1982

[30] Foreign Application Priority Data

Apr. 7, 1982 [DE] Fed. Rep. of Germany 3213005

[51] Int. Cl.⁴ F16K 37/00; F16K 31/02

[52] U.S. Cl. 137/554; 137/625.65; 137/625.26; 251/129.15; 251/310

[58] Field of Search 137/554, 625.65, 625.26, 137/516.25; 251/129.15, 310

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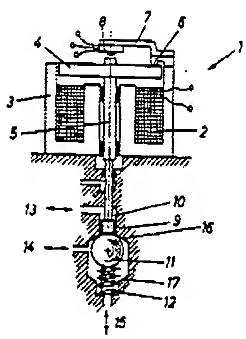
Primary Examiner—Alan Cohan
Assistant Examiner—John Rivell
Attorney, Agent, or Firm—Edwin E. Greigg

[57] ABSTRACT

A valve arrangement which assumes at least two positions and a monitoring system which is to monitor the functional performance of the valve arrangement. A valve closing body is connected to a slider which slides in sealing fashion in the opening to be closed by the valve closing body so that the opening is not set free until after lifting of the valve closing body and the slide sets free the opening.

6 Claims, 3 Drawing Figures



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US-PAT-NO: 4711266

DOCUMENT-IDENTIFIER: US 4711266 A

TITLE: Valve arrangement

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	1	U	Current	Current X	Pa	Document I	Title
125			166/66.7	251/129.1	22	US 4796708	Electrically actuated safety valve for
126			137/595	251/129.1	21	US 4787414	Fuel control valve construction, parts
127			347/54	251/129.1	6	US 4737802	Fluid jet printing device
128			251/129.	239/585.2;	20	US 4725041	Fuel injection apparatus and system
129			188/282.	137/614.2;	9	US 4723640	Adjustable hydraulic vibration dampe
130			137/554	137/625.2	4	US 4711266	Valve arrangement
131			239/125	239/451;	4	US 4708289	Injection valve

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512
527

3

2 – material

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Species 1 – directed adjustment using adjust member or adjust unit lengths